

PROGRESS REPORT
GRANT
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**AN ETA MODEL TRANSFERABILITY STUDY WITH APPLICATIONS TO THE
HYDROLOGICAL CYCLE OF THE LA PLATA BASIN**

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1. Objectives

One of GEWEX Americas Prediction Project (GAPP) goals is to investigate to what degree methodologies developed for data rich regions (e.g., the Mississippi basin) can be applied to data sparse regions of the world, and in particular to the La Plata basin in South America. GAPP has identified as a contribution to CEOP to develop a transferability experiment covering a period of at least one annual cycle.

The objective of this low-cost project is to demonstrate the applicability of notions developed during GCIP. Particular interest of this transferability study will be put on the routine computation of regional water and energy budgets, evaluate the regional Eta model over different climatic regions of South America and make adjustments (if necessary) to the specific character of the region. The evaluation will be done in collaboration with scientists of several countries in South America, to ensure a successful transferability. The model assessment will include (a) its performance in terms of precipitation and winds (where available) in the La Plata basin; (b) its potential to reproduce the low-level jet east of the Andes that feeds moisture into the La Plata basin; and, lastly, (c) its functioning over complex mountainous terrain. The output of these model runs are available on the World Wide Web at the URL address:

<http://www.meto.umd.edu/~berbery/etasam>.

2. Results

2.1 New developments

A newer version of the Eta model has been installed and parallel runs are being executed to assess the changes from the original model. Slight changes in output domain were also included to improve the representation of fields over the oceans. A higher resolution (22 km of grid spacing) over La Plata basin was developed, installed and working.

2.2 Contributions to SALLJEX

The South American Low Level Jet Experiment (SALLJEX) is the first of a series of experiments that will attempt, during a rigorous data gathering field phase, to monitor, quantify, and analyze low-level circulations that modulate regional rainfall. The scientific objectives of SALLJEX are to understand the role of the South American low-level jet in moisture and energy exchange between the tropics and extratropics, and related aspects of regional hydrology, climate and climate variability. The field phase of SALLJEX took place from November 15, 2002 to 15 February, 2003. [Information taken from the SALLJEX Project Office at UCAR Joint Office for Science Support.]

This transferability project contributed to the Field Campaign by making available Eta model daily products that are now archived at JOSS. Also, the forecasts of the 22 km version of the Eta model were employed in the daily operations, in particular during the period where flights were being programmed.

2.3 Visiting Scientists

During 2002 we received the visit of three scientists from Argentina (following same number of visitors from Peru the year before). Two of the visits were short term to coordinate activities on the La Plata basin hydrologic cycle and climate variability. The third one (E. A. Collini) was for a period of three months with the objective of helping in the update of the model setup, and to perform long term runs of the Eta model to test its stability in climate mode, explore the sensitivity of precipitation to lower boundary conditions, and many other experiments needed for this project.

2.4 Evaluations of the Eta model

The model's performance is being evaluated for diverse climate regimes, which requires different approaches according to the region. The evaluation is being done in collaboration with scientists of several countries in South America, to ensure a successful transferability. Fortunately, there are several opportunities to achieve this, as described in section 2.6. The Eta model precipitation forecasts are being evaluated systematically using a special data set of daily observed precipitation distributed by the Climate Prediction Center. The results have been remarkable for all seasons, even in subtropical regions. This is encouraging for the next step, that requires the development of a regional climatology of the hydrological cycle.

2.5 The hydrologic cycle of the La Plata basin

An article was published in the *J. Hydrometeorology* examining the main components of the hydrological cycle of the La Plata Basin in southeastern South America. A combination of observations, satellite products and National Centers for Environmental Prediction/National Center for Atmospheric Research (NCEP/NCAR) global reanalyses were employed to synthesize the basic character of the hydrologic cycle.

By analysis of the Eta output we have found a dipole pattern of precipitation between the monsoon and the central La Plata basin in the higher frequencies (it was known in lower frequencies). The LLJ has a significant role in this pattern as it experiments lateral shifts during the warm season. When the LLJ has an eastward shift, it can supply moisture directly to the monsoon region, where increased precipitation is detected. Meanwhile, the moisture supply to the La Plata basin becomes weaker and a simultaneous decrease of precipitation is found over Southern Brazil/Northern Argentina/ Uruguay. When the jet shifts west, its core acquires a more southward direction, effectively reducing the moisture supply to the monsoon but increasing it to the La Plata basin with the corresponding changes in precipitation. This dipole pattern is currently being documented.

2.6 Groups benefitting of this transferability project

This project offers free access to the model forecasts currently produced with a resolution of 80 km and the newer 22 km version (<http://www.atmos.umd.edu/~berbery/etasam>).

In general, groups that benefit from this project include: (1) Scientists that do not have the resources but need consistent regional data sets. Typically used to: (a) define initial conditions from this data set for land surface models and other type of models; (b) diagnostic studies; (c) comparison and assessment of the Eta and other local models. (2) Scientists interested in running the model themselves: Training at the University of Maryland.

Specific groups that are receiving additional information for their research studies:

- *Argentine National Water Institute (Instituto Nacional del Agua)*. Selected products of the Eta model are being provided to researchers who currently use rain gauges and satellite estimates for their studies of the sub-basins of the La Plata basin; this is expected to be a direct link to hydrological applications.
- *Department of Atmospheric Sciences, University of Buenos Aires*. Dr. V. Barros and collaborators are developing a model of soil moisture for the La Plata basin that will use as initial data the output of the Eta model run in Maryland.
- *Argentine Navy's weather service (SMARA)*. A scientist is helping maintain the web site and other needs with the model. They also do systematic use of the Eta model forecasts for guidance to navigation.
- *Peru's weather service (SENHAMI)*. Interactions are ongoing with researchers at this institute.
- *Facultad de Ciencias, Uruguay*: Selected products of the Eta model are being provided to researchers for their research and model evaluation.
- *The community in general*. Selected processed output of the model was provided to JOSS for archiving and distribution purposes.

3. Meetings and publications

- Berbery, E. H., and V. R. Barros, 2002: The hydrologic cycle of the La Plata basin in South America. *J. Hydrometeor.*, **3**, 630-645.
- Nogués-Paegle, J., C. R. Mechoso, R. Fu, E. H. Berbery, and coauthors, 2002: Progress in Pan American CLIVAR research: Understanding the South American monsoon. *Meteorologica*, accepted.
- Vera, C. S., P. K. Vigliarolo and E. H. Berbery, 2002: Cold season synoptic scale waves over subtropical South America. *Mon. Wea. Rev.*, **130**, 684-699.
- Berbery, E. H., E. Collini and M. Pyle, 2002: Mesoscale Diagnosis and Simulation of the South American Monsoon System. **(Invited)**. *American Geophysical Union*, San Francisco, Dec. 2002.
- Berbery E. H., and V. R. Barros, 2002: The Hydrologic regime of the La Plata basin in South America, *American Geophysical Union*, San Francisco, Dec. 2002 .

- Berbery, E. H., and E. A. Collini, 2002: On the structure and seasonality of the Low-level Jet east of the Andes, *3rd PROSUR PIs meeting*, Mar del Plata, Oct. 2002.
- Berbery, E. H., 2002: The American monsoons, *GEWEX Hydrometeorological Panel*, Sep. 2002.
- Berbery, E. H., 2002: La Plata basin: Modeling of its precipitation regimes and their relation to the Low-level Jet east of the Andes, *PLATIN Scientific Study Group*, Buenos Aires, Apr. 2002.
- Berbery, E. H., Y. Luo, K. Mitchell, and R. Yang, 2002: Diagnosis and simulation of the North American monsoon using NCEP's Eta model, EDAS, and Regional Reanalysis, *VAMOS Panel Meeting*, Costa Rica, Mar. 2002.